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INSTRUCTIONS:
NEW PCN FOR SILO 3 NHASP

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40430-PL-0010	1PCN3	APPROVED	SILO 3 RETREIVAL AND DISPOSITION NUCLEAR HEATH AND SAFETY PLAN	ATT: RAYER, DIANA L Project: 40430

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EFFECTIVE DATE	PCN NO.	REV. NO.	DESCRIPTION
03-23-05	2	1	Changes to: (1) Section 1.4.3, *Silo 3 Material Retrieval and Packaging Activities*, to describe the in-line automatic samplers installed above Packaging Stations A and B; (2) Section 10.4, *Derivation of Safety Basis Requirements*, to make text consistent with PR-3; (3) Appendix B, under *Executive Summary*, and Sections B-3.2.3 and B-3.3, to change facility designation from Radiological to Less Than Nuclear; (4) Section, B-4.0, *Final Hazard Category*, to clarify purpose of Appendix G, and to change facility designation from Radiological to Less Than Nuclear; (5) Appendix F (FHA), on Pages 8, 16, 18, and 21, to remove the word "DELETION" left over from a previous PCN; (6) Appendix G, *Accident Analysis*, under Section G-2.3, *Common Assumptions*, to explain the calculated bulk density of 73 lb/ft^3 used in EBA-4; (7) Section G-3.4, *EBA-4: Breach of Full Package*, to discuss the calculated bulk density of 73 lb/ft^3; (8) Table G.3-4, *Breach of a Full Package Scenario Results*, to provide new dose values; (9) Section G-3.7, *EBA-7: ISO Penetrated*, to clarify ISO staging; (10) Table G.4-1, *Dose for Comparison to Emergency Guideline*, to provide new dose values for EBA-4; (11) Table G.4-2, *Dose for Comparison to Emergency Guideline Using Conservative Assumptions*, to provide new dose values for EBA-4; (12) App. G, Att. 4, *EBA-4 Spreadsheet, EBA-4 Solids Release*, to provide new dose values based on calculated bulk density of 73 lb/ft^3.
4/18/05	3	1	Changes to: (1) Section 1.4.3, *Silo 3 Material Retrieval and Packaging Activities*, under *Preliminary Pneumatic Retrieval and Equipment Installation*, to make past tense and to delete references to vacuum wand boots; and under *Routine Pneumatic Retrieval*, to delete discussions of vacuum wand boots; (2) Table 10-1, *Silo 3 System Safety Requirements*, to delete PR-4 regarding the flexible boots on the vacuum wands per DCN 40430-JEG-277 and DCN 40430-JEG-278; (3) Section 10.4, *Derivation of Safety Basis Requirements and Process Requirements*, to explain deletion of PR-4.

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wall. On Silo 3, this would cause contamination of the work area. This demonstrated that the project must conservatively assume that a breach will occur and dress workers in appropriate PPE. In the event of a breach, the cut location can be temporarily sealed to contain the material. Additional measurements will be made after the track is reset to check clearances and adjust for silo curvature. Cuts will be made in three passes with the depth of the last cut to be adjusted.

- Installation of the wall braces was cumbersome at Silo 4 because there was no building on which to mount rigging (a manlift was used). For Silo 3, rigging can use the excavator roof structural steel. Improved brackets that braces could slide into would allow quicker installation and removal. A mounting/lifting bracket was designed to be compatible with the excavator attachment mounting plate and was used for removal of some of the braces. This was found to be a quicker and safer than using a hoist, and could be done remotely.

- Scoring of the concrete prior to removal resulted in defined boundaries for each section and allowed for control of the amount of concrete to be removed. The freeze-thaw effects on Silo 4 concrete caused the sections to fracture rather than remaining as whole sections; however, the fracturing remained within the grid. The mounting bracket for segment removal was used and demonstrated. Adjustments were made to the bracket installation work steps. The excavator handled the pieces within the design footprint of the excavator room. The selection of excavator attachments was demonstrated and an assessment of each piece was made.

- Measurements were made for the placement of the cable management system, tethered electric line, and closed-circuit television cameras. Cameras were not available to provide views of the far side from the control area. The operator walking and visually working with the machine was used to document the views and camera locations that will be needed during Silo 3 operations.

The following recommendations will be evaluated by engineering and will be incorporated, as appropriate, into the Silo 3 equipment, design, and work planning [Ref. 22]:

1. Revise the excavator cable management location. Locate camera mounting brackets on the excavator. Paint the boom in contrasting colors for depth perception.

2. Provide additional attachments, such as a modified bucket or tools to address variable concrete conditions, including removal of rubble in addition to whole pieces.

3. Modify the mounting bracket installation.

4. Procure additional mounting brackets and longer hydraulic hoses for the wall saw.

5. Design wall braces that can be remotely removed from the Silo 3 wall opening using the excavator. The brace design will account for live load of Silo 3 material behind the wall.

6. After the final brace design is received, revise the construction traveler to incorporate redline comments and revised work steps. (A construction traveler is a subcontractor-produced, FCP-reviewed/approved work plan that outlines how construction will perform work safely.)

7. Evaluate the need for vertical as well as horizontal braces.

8. Update the safety briefing on equipment and the construction traveler. Prior to initiating Silo 3 penetration, show that the activity can be performed as planned per the Operations Work Instructions specified in this N-HASP (TABLE 10-1, SBR-1).

1.4.3 Silo 3 Material Retrieval and Packaging Activities

This section provides a more detailed explanation of the operational steps of Silo 3 material retrieval and packaging.

Preliminary Pneumatic Retrieval and Equipment Installation

Before routine pneumatic retrieval of material began, some preliminary retrieval had to be done.

The contour of material in Silo 3 was estimated to be variable with piles located below the fill manways and center access, leaving very little headspace. This material contour could interfere with the operation of the pressure monitoring instrumentation and the pressure control valve. The pressure control valve (PSV-SILO-10-5070B) and the pressure monitoring instrument (PIT-SILO-10-5070) are needed to ensure that silo pressure does not become excessively negative during pneumatic retrieval. PSV design function is dependent on free communication to each of the vacuum wand manways. If the material contour creates a pocket between a manway and the PSV, an out-of-specification vacuum could be drawn in a small portion of the dome and the PSV would not sense it. As seen during mock operations, controlling vacuum pressure within the silo is critical when there is little headspace. During mock operations, two events occurred during pneumatic retrieval that resulted in pressures reaching −3.5 INWC and container deformation. This lesson learned clearly shows the requirement for the PSV to have free communication throughout the Silo dome. Therefore, sufficient material had to be retrieved at each manway to allow for: (1) unobstructed airflow between the dome locations where the pressure control valve and pressure monitoring instrument would be installed; (2) unobstructed airflow from each of the manways to the pressure control valve and pressure monitoring instrument; and (3) installation of the camera and lighting in the center manway. The camera and lighting assembly would be used to verify that a clear airflow path exists to each of the manways. To achieve this, sufficient material had to be removed prior to installation of the wand systems. PCN3

To accomplish initial headspace ventilation and pneumatic retrieval for equipment installation, temporary alternative ventilation was provided. Two Silo Ventilation Hose Connections with isolation valves were installed near the center manway on two existing six-inch flanges. Once installed, initial ventilation of the silo headspace was performed using the Auxiliary PRS Blower (BLR-10-5008). This initial venting reduced the accumulated radon in the headspace through the stack. Positioning the bypass on the Pneumatic Retrieval System (PRS) line to the Supply HEPA (FLT-10-5070) controlled the amount of vacuum (cfm). This method of ventilation was verified during the receipt of fly ash into the Silo 3 Mockup ISO container. PCN3

During the pneumatic retrieval of material for equipment installation, local ventilation was provided by the Process Ventilation System (PVS) via the Silo Ventilation Hose Connections. Also, a

temporary blanket for covering the manway was used to minimize airborne contamination. While maintaining ventilation on Silo 3 via the PVS, the center manway was opened, pulling air into the manway. The PRS was then started to remove enough material to allow the installation of the Camera and Lighting Assembly into the center manway (approximately eight feet below the manway flange).

While continuing to maintain ventilation on the silo via the PVS, each of the remaining five (5) manways was opened one at a time. Once the manway cover was removed, enough material was again removed to allow airflow to the center manway. This level was determined using the center manway camera. Once this level was achieved, a Manway Vacuum Wand Management System was installed on the manway. This continued until all five Manway Vacuum Wand Systems were installed. PCN3

Routine Pneumatic Retrieval

Note: Prior to installation, the design of the pneumatic retrieval components will be evaluated against, and conform to, the Technical Safety Requirement (TSR) specified in Section 10.3. The pneumatic retrieval strategy has a demonstration plan [Ref. 25] for vacuum wand retrieval and will separately document the results.

The VWMS is installed on the silo dome beneath a fabric enclosure structure that provides protection from the weather. The VWMS consists of flexible hoses and metal tubes (vacuum wands) that will be inserted through the six existing silo dome manways. A motorized hoist will be used at each manway to assist operators in manipulating the VWMS hoses/wands. Video cameras to allow for remote viewing.

At each vacuum wand (and associated manway), an enclosure is provided with passive air supply (inlet) and process vent (outlet) hose connections. DELETION PCN3

In order to keep silo pressure from becoming too negative, the passive air supply (from a HEPA filter) will replace air displaced during pneumatic retrieval and process vent operations. The process vent connection will normally be used to provide slight negative pressure when vacuum wand sections are added and when the pneumatic retrieval (vacuum) system is not in operation.

A vacuum relief valve on the passive air supply piping will open at 3 inches water column (WC) vacuum in the event the HEPA filter becomes plugged or does not allow sufficient air flow to alleviate silo negative pressure.

DELETION. There is a pressure transmitter on the silo dome to provide an alarm if the silo pressure becomes greater than 3 inches WC vacuum. The pneumatic system also has a low-pressure switch on the blower inlet that will open a blower inlet relief valve, and a low-flow switch to shut down the blower in the event of a plug in the pneumatic system or the passive air supply. PCN3

The PRS is contained in a steel beam/metal-sided building (the Process Building) adjacent to the silo. The PRS provides pneumatic, vacuum flow using rotary blowers. From the VWMS, the material/air stream enters the PRS baghouse collector, where material is separated from the air stream and fed by a screw conveyor and rotary airlock to the packaging screw conveyor. The air

stream from the PRS baghouse collector passes through a cartridge filter, a high-efficiency particulate air (HEPA)/ ultra-low penetrating air (ULPA) filter, and rotary blower and is discharged via the Silo 3 exhaust stack. Material collected by the cartridge filter is fed by the same screw conveyor and rotary airlocks to the packaging screw conveyor.

Pneumatic retrieval will be performed to the extent practicable (i.e., as long as material can be safely and effectively removed by vacuum). Of significant importance is the use of the VWMS/PRS for removal of material from behind the silo wall, at the proposed access location, to permit safe wall opening for mechanical retrieval. The VWMS/PRS can be used prior to the MRS and in conjunction with it.

Mechanical Retrieval

The Mechanical Retrieval System (MRS) is housed in a robust concrete structure (Excavator Building) attached to the silo structure. When free-flowing material has been removed from the silo to expose the inside of the silo wall, and pneumatic retrieval is no longer practical, an opening will be cut into the exposed silo wall to enable the use of a mechanical excavator (see Section 1.4.2). Compacted material remaining behind the wall will not prevent initiation of wall removal.

The selected excavator has an additional articulating joint. This provides a range of motion that allows it to work within the silo and adjoining excavator room. The machine can also articulate in a horizontal plane. This provides flexibility for supporting retrieval if only portion of the wall can be removed due to material impacted behind the wall.

The excavator can reach into the silo and loosen compacted material for vacuuming. Video cameras to allow for remote viewing. The excavator may also be used to manipulate the VWMS wand/hose to facilitate pneumatic retrieval. The remotely-operated excavator will enter the silo and dig into the waste pile. Removed material will be placed in a below-grade bin in the Excavator Room and then moved to the two packaging stations via four conveyors. Three of the conveyors are screw-type, and one is a pocketed sidewall belt conveyor. The last of the screw-type conveyors is common to the PRS.

Waste Conditioning

As the Silo 3 material is containerized, it will be conditioned by the addition of an aqueous solution to reduce dispersibility and metals mobility. The solution of ferrous sulfate, sodium lignosulfonate, and water will be sprayed onto the material in the fill chutes at the packaging stations. No credit was taken for waste conditioning in the hazard category calculations.

10.2 Silo 3 System Safety Requirements

The matrix in **TABLE 10-1** has been developed to identify Silo 3 System Safety Requirements, reference the origin of the requirements, and identify the method(s) of control and implementing document(s), as appropriate. These System Safety Requirements are provided for Defense-in-Depth. Table 10-1 is the requirements matrix pursuant to the DOE-approved *Decision Basis Document Implementation of 10 CFR 830 Safe Harbor Requirements for the Silos Projects,* 40000-RP-0034 [Ref. 1]. Table 10.1 identifies the requirements of the written site safety and health program and project specific requirements that relate to system safety and are relied upon for maintaining the safety envelope.

As identified in Appendix G, *Silo 3 Accident Analysis*, there are no safety class or safety-significant components associated with the Silo 3 Retrieval and Disposition Project. This is based on the fact that Silo 3-initiated accident scenarios do not yield consequences that would exceed on-site dose limits, nor was any mitigation credit taken for these systems, structures, and components in the consequence analysis. However, SBRs and PRs were developed around some components to provide defense-in-depth.

TABLE 10-1: SILO 3 SYSTEM SAFETY REQUIREMENTS

SBR, PR	Requirement	Basis/Source	Implementation
SBR-1	Wall cutting activity, for mechanical retrieval, must be authorized by updated documentation, including but not limited to an Unreviewed Safety Question Determination (USQD) and Operations Work Instructions.	Although consequences are analyzed in this document as EBA-2 (see Appendix G), the wall cutting activity is authorized in the Silo 3 PHAR [Ref. 14] and the work will be done by Construction.	• NS-0002 • Management assessment
PR-1	The Silo 3 stack monitoring capability will be maintained within defined operability parameters, with established action level thresholds and operating limits. Operating data from the particulate filtering system (i.e., pressure differential) can be relied upon during maintenance events on the stacks samplers.	Public and Worker Protection, Environmental Protection Agency (EPA) Required	• 40000-PL-012, *Silos Engineering Project Execution Plan* (i.e. Silos Design Change Notice) • Operations procedures • Routine calibration and maintenance • Routine inspections • Engineering design

TABLE 10-1: SILO 3 SYSTEM SAFETY REQUIREMENTS

SBR, PR	Requirement	Basis/Source	Implementation
PR-2	Individual IP-2 bulk bags shall not exceed 7000 lbs. gross weight.	EBA-4 (App. G) Test Report for IP-2 Container Testing [Ref. 65]	• Operations procedures • Routine inspections • Engineering design • Routine calibration and maintenance
PR-3	Verify that IP-2 bulk bags/packages are sealed per the IP-2 Container Closure Instructions [Ref. 66] before transfer outside of the Cargo Bay area. If a package is rejected because it cannot be sealed, it may be relocated outside the Cargo Bay area, but only one reject package may be moved at a time.	Shipping requirement EBA-4 (App. G) Test Report for IP-2 Container Testing [Ref. 65] Engineer Evaluation of IP-2 Containers [Rev. 67]	• Operations procedures • Routine inspections • Engineering design • Routine calibration and maintenance
~~PR-4~~	DELETED (SEE DISCUSSION IN SECTION 10.4, *DERIVATION OF SAFETY BASIS REQUIREMENTS AND PROCESS REQUIREMENTS*)	DELETED	DELETED
PR-5	During pneumatic retrieval operations, a vacuum relief valve must be installed on Silo 3, set to -3.0 inches of water, with alarm indication. NOTE: Does not apply to Preliminary Pneumatic Retrieval and Equipment Installation.	Dome Failure, protect Silo Dome TSR	• I-TAB • Routine inspections • Engineering design • Routine calibration and maintenance
PR-6	Preliminary Pneumatic Retrieval and Equipment Installation will be performed per the OWI package as reviewed and approved by an SSA.	Consequences bounded by EBAs in Appendix G. Public and Worker Protection, Containment	• OWI
PR-7	No more than 8 sealed, soft- sided containers may be staged in the ISA or other staging area without being in an ISO.	EBA-6, EBA-7 (App. G) Public and Worker Protection, Containment	• Administrative control
PR-8	ISOs containing Silo 3 materials shall not be stacked more than two high.	EBA-6, EBA-7 (App. G) Public and Worker Protection, Containment	• Administrative control

PCN3

Identification of the required SBRs and PRs was completed by a team of Silos personnel representing Operations, Quality Assurance, Engineering, Project Safety, and Nuclear and System Safety. Although none resulted in significant radiological consequences, each of the seven EBAs described in Appendix G, as well as Environmental and Operational ALARA details, were considered for potential requirements to protect the Hazard Categorization.

Examination of EBA-1 (hose rupture) did not result in any single component or administrative control that required special protection, as the equipment was of rigorous design and construction, and detection of any spill resulting from hose rupture would be immediate in the occupied facility. Examination of EBA-2 (silo failure due to wall cutting) resulted in SBR-1, to ensure that the work plan for cutting into the Silo 3 wall was documented and implemented with the proper rigor. Examination of EBA-3 (material spill from conveyor) also did not result in any single component or administrative control that required special protection. As was the case for EBA-1, the equipment was of rigorous design and construction, and detection of any spill resulting from conveyor failure would be immediate in the occupied facility.

EBA-4 (package failure during transport to pallet) was examined and two PRs were developed for this scenario. Both PR-2 (gross weight at or below 7000 pounds) and PR-3 (bag are sealed before transfer to ISA) describe maintaining the bags within the parameters tested for DOT compliance. EBA-5 (filter system failure during retrieval) was examined but did not result in any single component or administrative control that required special protection. This was due to the fact that an abrupt pressure change resulting in filter failure had multiple levels of prevention, and consequences were limited by the immediate loss of ability to pneumatically retrieve. PCN2

PRs 1, 4, 5, and 6 were developed to protect parameters outside the EBA scenarios. PR-1 requires capability to measure stack concentration, to meet an environmental release requirement for radon. PR-4 was deleted with PCN3 of this N-HASP. PR-4 required a visual inspection of the fabric boot that sealed the Silo to the pneumatic retrieval system. Initial vacuum wand operation demonstrated that process ventilation at the manway ventilation ring provides adequate airborne containment without use of the boot. Retrieval is less difficult without the boot because operators can directly see the operation. The potential for significant negative pressure within the silo is essentially eliminated without the boot. PR numbering is being maintained to minimize negative impact on referencing procedures. PR-5 protects the TSR for the Silo dome, as it requires the vacuum relief valve to be set properly to prevent underpressurization of the silo that could cause dome collapse. PR-6 is an administrative control that requires review of an Operation Work Instruction (OWI) package for preliminary pneumatic retrieval and equipment installation. PCN3

EBAs 6 and 7 were added when staging of material in the ISA was better defined in the scope of the N-HASP. Two PRs were developed for defense-in-depth of material staging. PR-7 limits sealed bags not contained in an ISO to eight, and PR-8 limits the stacking of the ISOs to two high.

11.0 TRAINING REQUIREMENTS

The *Silos Project Training and Qualification Program (TQP) Description*, TQP-067, [Ref. 69] establishes the training and qualification requirements for Silos personnel. The program's objectives are to:

- ensure that workers understand the potential hazards they may encounter.
- ensure that workers possess the knowledge and skills necessary to perform their work with minimal risk to their health and safety.
- ensure that workers are aware of the safety requirements, including the purpose and limitations of safety equipment.
- ensure that workers can safely avoid or escape from emergencies.

The program ensures that workers meet the minimum requirements of 29 CFR 1910.120, DOE Order 5480.20A [Ref. 70] (applicability as described in RM-0043, *FEMP Training Implementation Matrix* [Ref. 71], and other relevant regulations, as applicable.

Health and Safety Training

Workers will receive the appropriate training based on their scope of work. Workers performing activities which fall under 29 CFR 1910.120 [Ref. 72] will receive a required number of hours of initial and annual-refresher health and safety training for hazardous waste site operations. In addition to the initial health and safety training, workers will receive one to three days of directly-supervised field experience.

All personnel performing work under 29 CFR 1910.120 are required to be trained per RM-0055, *FEMP Access* [Ref. 73], in one of the following categories:

- Occasional Site Worker
- General Site Worker

Workers whose work scope does not require hazardous waste site operations training will receive a level of training that is specific to the type of activities to be performed and the hazards to be encountered. Personnel may not participate in field activities until they have been appropriately trained.

Job and Safety Briefings (all hazards)

Before commencement of field activities, all personnel performing fieldwork will participate in a briefing that will specifically address the activities, procedures, monitoring, and equipment used in the work. The briefing will include a description of the work to be accomplished, known hazards (all types), administrative controls, and PPE requirements. This briefing will also allow field workers to receive clarification of anything they do not understand and to confirm their responsibilities regarding safety and operations for their particular activity.